

and there knotty globular patches, as if the meteor in its flight had shed occasional larger masses of incandescent matter.

The trail was tubular or consisted of two parallel narrow ribbons, each component being about twice the angular diameter of *Jupiter*, or about 90'' in width, separated by an interval of about 5''. The trail remained feebly visible to the naked eye for some minutes, but telescopic observation showed it to be diffusing into nebulous patches, with sufficient luminosity to render comet-seeking futile from the time of first observation, 11.39 P.M., until midnight.

The position of the telescope at the time of appearance was R.A. 0^h 45^m, Dec. +28°. Approximate position of trail was from Dec. +15° to +35°, in a circle of R.A. at 0^h 45^m.

Ephemeris for Physical Observations of the Moon for 1905.

By A. C. D. Crommelin.

Greenwich. Midnight.	Selenographical		Geocentric Libration.		Physical Libration.		C.
	Colong. of the Sun.	Lat.	Sel. Long. of the Earth.	Lat.	Long.	Lat.	
1905. Jan. 1	219°25	+1°32	+3°84	-6°29	+°004	+°004	14°34
2	231°43	+1°31	+4°42	-6°58	+°004	+°004	9°11
3	243°61	+1°30	+4°83	-6°49	+°003	+°005	3°32
4	255°80	+1°28	+5°01	-6°05	+°003		357°40
5	267°98	+1°27	+4°94	-5°29	+°002		351°72
6	280°17	+1°26	+4°57	-4°28	+°001		346°61
7	292°37	+1°24	+3°91	-3°08	°000		342°31
8	304°55	+1°23	+2°99	-1°75	-°002		338°97
9	316°73	+1°21	+1°83	-0°37	-°004		336°65
10	328°91	+1°20	+0°51	+1°02	-°006		335°37
11	341°08	+1°19	-0°89	+2°35	-°008		335°11
12	353°25	+1°17	-2°29	+3°58	-°010		335°86
13	5°41	+1°15	-3°60	+4°67	-°012		337°59
14	17°54	+1°14	-4°72	+5°57	-°014		340°31
15	29°71	+1°12	-5°57	+6°23	-°016	+°005	343°97
16	41°86	+1°10	-6°09	+6°61	-°018	+°006	348°53
17	53°99	+1°08	-6°22	+6°67	-°019		353°86
18	66°13	+1°06	-5°94	+6°37	-°019		359°74
19	78°25	+1°03	-5°29	+5°69	-°019		5°85
20	90°38	+1°01	-4°31	+4°65	-°020		11°73
21	102°50	+0°98	-3°08	+3°30	-°019		16°91
22	114°63	+0°96	-1°71	+1°72	-°018	+°006	20°99

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Greenwich Midnight.	Selenographical		Geocentric Libration.		Physical Libration.		C.
	Colong. of the Sun.	Lat.	Sel. Long. of the Earth.	Lat.	Long.	Lat.	
1905.							
Jan. 23	126°76	+0°93	-0°30	+0°02	-°018	+°006	23°69
24	138°90	+0°91	+1°06	-1°68	-°017		24°86
25	151°04	+0°88	+2°30	-3°25	-°016		24°51
26	163°18	+0°85	+3°38	-4°61	-°015	+°006	22°70
27	175°34	+0°83	+4°26	-5°67	-°015	+°007	19°61
28	187°50	+0°80	+4°94	-6°37	-°015		15°41
29	199°67	+0°78	+5°39	-6°71	-°014		10°37
30	211°85	+0°76	+5°61	-6°67	-°014		4°78
31	224°03	+0°73	+5°61	-6°28	-°014		358°98
Feb. 1	236°22	+0°71	+5°37	-5°57	-°015		353°30
2	248°41	+0°69	+4°91	-4°60	-°015		348°07
3	260°60	+0°66	+4°21	-3°42	-°017		343°54
4	272°80	+0°64	+3°31	-2°09	-°018		339°91
5	284°99	+0°62	+2°22	-0°69	-°020		337°28
6	297°18	+0°60	+0°97	+0°73	-°022		335°67
7	309°37	+0°57	-0°39	+2°10	-°024	+°007	335°09
8	321°56	+0°55	-1°79	+3°38	-°026	+°008	335°54
9	333°74	+0°53	-3°18	+4°52	-°028		336°97
10	345°92	+0°50	-4°49	+5°47	-°030		339°35
11	358°10	+0°48	-5°63	+6°20	-°032		342°64
12	10°26	+0°45	-6°52	+6°66	-°033		346°81
13	22°42	+0°42	-7°10	+6°81	-°034		351°75
14	34°58	+0°40	-7°30	+6°63	-°035		357°32
15	46°73	+0°37	-7°08	+6°10	-°035		3°24
16	58°87	+0°34	-6°43	+5°19	-°035		9°19
17	71°01	+0°31	-5°36	+3°95	-°035		14°71
18	83°15	+0°27	-3°95	+2°41	-°035		19°35
19	95°28	+0°24	-2°28	+0°69	-°034	+°008	22°72
20	107°41	+0°21	-0°48	-1°10	-°033	+°009	24°5
21	119°55	+0°18	+1°32	-2°81	-°032		24°79
22	131°69	+0°15	+3°00	-4°31	-°031		23°41
23	143°84	+0°12	+4°45	-5°50	-°030		20°59
24	156°00	+0°09	+5°58	-6°33	-°029		16°55
25	168°16	+0°06	+6°37	-6°75	-°028		11°59
26	180°33	+0°03	+6°80	-6°78	-°028		6°06
27	192°51	0°00	+6°87	-6°45	-°028		0°26
28	204°69	-0°02	+6°61	-5°80	-°029		354°55
Mar. 1	216°89	-0°05	+6°07	-4°87	-°029	+°009	349°25

Greenwich Midnight.		Selenographical		Geocentric Libration.		Physical Libration.		C
		Colong. of the Sun.	Lat.	Sel. Long. of the Earth.	Lat.	Long.	Lat.	
1905.								
Mar.	2	229°08	-0°08	+5°29	-3°73	-0°30	+0°09	344°60
	3	241°28	-0°10	+4°30	-2°44	-0°31		340°77
	4	253°49	-0°13	+3°15	-1°05	-0°32		337°88
	5	265°69	-0°15	+1°89	+0°37	-0°34		336°0
	6	277°90	-0°18	+0°54	+1°77	-0°36	+0°09	335°16
	7	290°11	-0°20	-0°85	+3°09	-0°38	+0°10	335°33
	8	302°31	-0°22	-2°24	+4°27	-0°40		336°4
	9	314°51	-0°25	-3°59	+5°27	-0°41		338°61
	10	326°71	-0°27	-4°84	+6°05	-0°42		341°65
	11	338°91	-0°30	-5°95	+6°57	-0°43		345°53
	12	351°10	-0°33	-6°85	+6°80	-0°45		350°16
	13	3°28	-0°36	-7°49	+6°73	-0°45		355°42
	14	15°46	-0°38	-7°80	+6°32	-0°45		1°09
	15	27°63	-0°41	-7°73	+5°56	-0°45		6°88
	16	39°80	-0°44	-7°24	+4°48	-0°44		12°47
	17	51°96	-0°47	-6°32	+3°09	-0°44		17°41
	18	64°11	-0°50	-4°99	+1°46	-0°43		21°34
	19	76°26	-0°53	-3°30	-0°29	-0°42		23°91
	20	88°41	-0°56	-1°36	-2°06	-0°41		24°88
	21	100°56	-0°59	+0°69	-3°69	-0°39		24°18
	22	112°71	-0°62	+2°69	-5°05	-0°38	+0°10	21°88
	23	124°87	-0°65	+4°48	-6°04	-0°37	+0°11	18°16
	24	137°03	-0°67	+5°93	-6°61	-0°36		13°32
	25	149°19	-0°70	+6°95	-6°75	-0°36		7°74
	26	161°37	-0°72	+7°50	-6°50	-0°35		1°82
	27	173°55	-0°75	+7°60	-5°91	-0°35		355°94
	28	185°75	-0°77	+7°27	-5°03	-0°35		350°45
	29	197°94	-0°79	+6°60	-3°93	-0°35		345°61
	30	210°14	-0°81	+5°64	-2°67	-0°36		341°58
	31	222°36	-0°83	+4°47	-1°32	-0°37		338°48
Apr.	1	234°57	-0°85	+3°17	+0°08	-0°38		336°37
	2	246°78	-0°87	+1°78	+1°47	-0°39		335°28
	3	259°01	-0°89	+0°38	+2°78	-0°40		335°21
	4	271°23	-0°91	-1°01	+3°98	-0°42		336°12
	5	283°45	-0°93	-2°35	+5°01	-0°43		338°02
	6	295°67	-0°95	-3°59	+5°82	-0°45	+0°11	340°84
	7	307°89	-0°97	-4°72	+6°39	-0°46	+0°12	344°53
	8	20°11	-0°99	-5°71	+6°65	-0°47	+0°12	348°97

Greenwich Midnight.	Selenographical		Geocentric Libration.		Physical Libration.		C.
	Colong. of the Sun.	Lat.	Sel. Long. of the Earth.	Lat.	Long.	Lat.	
1905.							
Apr. 9	332°33	-1°01	-6°53	+6°65	-°048	+°012	354°04
10	344°53	-1°03	-7°13	+6°32	-°048		359°54
11	356°74	-1°05	-7°47	+5°67	-°048		5°11
12	8°94	-1°07	-7°51	+4°70	-°048		10°73
13	21°13	-1°09	-7°20	+3°46	-°047		15°77
14	33°31	-1°12	-6°50	+1°98	-°045		19°97
15	45°49	-1°14	-5°40	+0°33	-°044		23°02
16	57°66	-1°16	-3°92	-1°38	-°043		24°65
17	69°83	-1°18	-2°13	-3°02	-°041		24°71
18	81°99	-1°20	-0°12	-4°47	-°040		23°12
19	94°16	-1°22	+1°92	-5°60	-°039	+°012	19°99
20	106°32	-1°24	+3°84	-6°33	-°037	+°013	15°51
21	118°49	-1°26	+5°46	-6°62	-°035		10°05
22	130°67	-1°27	+6°65	-6°47	-°035		4°02
23	142°85	-1°29	+7°35	-5°95	-°034		357°89
24	155°04	-1°30	+7°55	-5°12	-°034		352°07
25	167°23	-1°31	+7°27	-4°05	-°033		346°89
26	179°44	-1°32	+6°59	-2°81	-°034		342°55
27	191°64	-1°33	+5°59	-1°47	-°034		339°18
28	203°86	-1°34	+4°37	-0°09	-°035		336°81
29	216°08	-1°35	+3°01	+1°27	-°035		335°47
30	228°31	-1°36	+1°59	+2°58	-°037		335°14
May 1	240°54	-1°37	+0°18	+3°77	-°038	+°013	335°81
2	252°77	-1°38	-1°15	+4°80	-°038	+°014	337°47
3	265°01	-1°39	-2°38	5°63	-°040		340°07
4	277°24	-1°40	-3°48	6°22	-°041		343°57
5	289°48	-1°41	-4°42	6°53	-°041		347°87
6	301°72	-1°42	-5°20	6°54	-°042		352°84
7	313°95	-1°43	-5°81	6°24	-°042		358°28
8	326°18	-1°44	-6°24	5°63	-°041		3°93
9	338°41	-1°45	-6°47	4°72	-°041		9°47
10	350°63	-1°46	-6°47	3°55	-°040		14°57
11	2°84	-1°47	-6°22	2°15	-°039		18°92
12	15°04	-1°48	-5°66	+0°61	-°038		22°22
13	27°25	-1°49	-4°79	-1°01	-°036		24°26
14	39°44	-1°49	-3°58	-2°60	-°034		24°86
15	51°63	-1°50	-2°08	-4°04	-°033	+°014	23°94
16	63°81	-1°51	-0°36	-5°23	-°031	+°015	21°48

Greenwich Midnight.	Selenographical Long. Lat. of the Sun.		Geocentric Libration. Sel. Long. Lat. of the Earth.		Physical Libration. Long. Lat.		C.
1905.							
May 17	75°99	-1°52	+1°45	-6°06	-°029	+°015	17°60
18	88°17	-1°52	+3°20	-6°48	-°028		12°53
19	100°35	-1°52	+4°73	-6°46	-°027		6°63
20	112°53	-1°53	+5°90	-6°03	-°026		0°38
21	124°72	-1°53	+6°63	-5°25	-°025		354°25
22	136°91	-1°53	+6°86	-4°20	-°024		348°65
23	149°11	-1°53	+6°63	-2°96	-°024		343°89
24	161°31	-1°53	+6°00	-1°61	-°023		240°11
25	173°52	-1°52	+5°03	-0°22	-°024	+°015	337°40
26	185°74	-1°52	+3°82	+1°15	-°025	+°016	335°75
27	197°97	-1°52	+2°48	+2°46	-°026		335°14
28	210°20	-1°51	+1°08	+3°66	-°027		335°54
29	222°43	-1°51	-0°28	+4°70	-°028		336°93
30	234°67	-1°51	-1°53	+5°54	-°029		339°28
31	246°91	-1°50	-2°64	+6°15	-°029		342°53
June 1	259°16	-1°50	-3°55	+6°48	-°030		346°65
2	271°41	-1°49	-4°27	+6°52	-°030		351°50
3	283°66	-1°49	-4°79	+6°24	-°031		356°89
4	295°91	-1°49	-5°11	+5°65	-°030		2°58
5	308°15	-1°49	-5°25	+4°75	-°029		8°24
6	320°39	-1°49	-5°22	+3°59	-°028		13°52
7	332°63	-1°48	-5°02	+2°21	-°027		18°05
8	344°86	-1°48	-4°63	+0°69	-°025		21°58
9	357°09	-1°48	-4°05	-0°90	-°024		23°89
10	9°30	-1°47	-3°25	-2°45	-°022		24°84
11	21°51	-1°47	-2°23	-3°87	-°020		24°35
12	33°72	-1°46	-1°02	-5°07	-°018		22°42
13	45°92	-1°45	+0°34	-5°95	-°016		19°10
14	58°11	-1°45	+1°77	-6°45	-°014		14°54
15	70°30	-1°44	+3°14	-6°53	-°012		9°02
16	82°50	-1°43	+4°34	-6°19	-°011	+°016	2°91
17	94°68	-1°42	+5°25	-5°48	-°010	+°017	356°68
18	106°87	-1°40	+5°80	-4°47	-°009		350°77
19	119°06	-1°39	+5°93	-3°24	-°009		345°59
20	131°26	-1°38	+5°66	-1°86	-°009		341°35
21	143°46	-1°36	+5°02	-0°44	-°008		338°32
22	155°67	-1°35	+4°07	+0°98	-°009		336°18
23	167°88	-1°33	+2°90	+2°33	-°009	+°017	335°23

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Greenwich Midnight.	Selenographical Colong. Lat. of the Sun.		Geocentric Libration. Sel. Long. Lat. of the Earth.		Physical Libration. Long. Lat.		0.
1905. June 24	180°11	-1°32	+1°60	+3°57	-°010	+°017	335°32
25	192°33	-1°30	+0°25	+4°64	-°011		336°42
26	204°56	-1°28	-1°06	+5°52	-°011		338°47
27	216°80	-1°27	-2°24	+6°16	-°012		341°45
28	229°04	-1°25	-3°25	+6°54	-°013		345°29
29	241°29	-1°24	-4°02	+6°63	-°013		349°92
30	253°54	-1°23	-4°54	+6°39	-°013		355°19
July 1	265°79	-1°21	-4°79	+5°84	-°013		0°87
2	278°05	-1°20	-4°80	+4°96	-°012		6°65
3	290°30	-1°18	-4°59	+3°79	-°011		12°16
4	302°55	-1°17	-4°20	+2°40	-°010		17°01
5	314°80	-1°16	-3°64	+0°85	-°009		20°87
6	327°04	-1°14	-2°94	-0°77	-°007		23°49
7	339°27	-1°13	-2°13	-2°36	-°005		24°75
8	351°50	-1°11	-1°23	-3°81	-°003	+°017	24°57
9	3°72	-1°10	-0°23	-5°04	-°001	+°018	22°98
10	15°94	-1°08	+0°82	-5°96	+°001		20°05
11	28°15	-1°06	+1°89	-6°51	+°003		15°90
12	40°35	-1°04	+2°92	-6°66	+°005		10°77
13	52°55	-1°02	+3°84	-6°41	+°006		4°94
14	64°74	-1°00	+4°58	-5°78	+°008		358°82
15	76°93	-0°97	+5°08	-4°83	+°009		352°84
16	89°13	-0°95	+5°29	-3°62	+°009		347°38
17	101°32	-0°93	+5°17	-2°25	+°010		342°78
18	113°51	-0°90	+4°74	-0°79	+°010		339°22
19	125°71	-0°88	+4°01	+0°68	+°010		336°77
20	137°91	-0°85	+3°02	+2°08	+°009		335°45
21	150°12	-0°83	+1°86	+3°38	+°009		335°20
22	162°33	-0°80	+0°57	+4°49	+°008		336°02
23	174°54	-0°78	-0°75	+5°46	+°007		337°73
24	186°76	-0°75	-2°03	+6°16	+°007		340°40
25	198°99	-0°73	-3°18	+6°61	+°006		343°93
26	211°23	-0°70	-4°14	+6°77	+°006	+°018	348°26
27	223°46	-0°68	-4°84	+6°62	+°005	+°019	353°28
28	235°71	-0°66	-5°25	+6°14	+°005		358°82
29	247°96	-0°64	-5°34	+5°34	+°005		4°61
30	260°21	-0°62	-5°11	+4°22	+°006		10°29
31	272°45	-0°59	-4°58	+2°84	+°007	+°019	15°47

Greenwich Midnight.	Selenographical Colong. Lat. of the Sun.		Geocentric Libration. Sel. Long. Lat. of the Earth.		Physical Libration. Long. Lat.		O.
1905. Aug. 1	284°70	-0°57	-3°79	+1°27	+0°08	+0°19	19°77
2	296°95	-0°55	-2°80	-0°41	+0°10		22°86
3	309°20	-0°53	-1°68	-2°08	+0°12		24°54
4	321°44	-0°51	-0°48	-3°62	+0°13		24°73
5	333°67	-0°49	+0°72	-4°93	+0°15		23°44
6	345°90	-0°46	+1°88	-5°93	+0°17		20°77
7	358°12	-0°44	+2°93	-6°55	+0°19		16°89
8	10°33	-0°41	+3°85	-6°77	+0°21		12°00
9	22°54	-0°39	+4°59	-6°59	+0°22		6°40
10	34°74	-0°36	+5°12	-6°04	+0°23		0°44
11	46°93	-0°33	+5°42	-5°16	+0°24		354°50
12	59°12	-0°30	+5°47	-4°01	+0°25		348°96
13	71°31	-0°27	+5°28	-2°67	+0°25		344°13
14	83°50	-0°24	+4°83	-1°22	+0°26		340°26
15	95°68	-0°21	+4°15	+0°25	+0°25	+0°19	337°46
16	107°87	-0°18	+3°25	+1°71	+0°25	+0°20	335°77
17	120°06	-0°15	+2°18	+3°06	+0°24		335°18
18	132°25	-0°12	+0°97	+4°26	+0°23		335°65
19	144°45	-0°09	-0°32	+5°27	+0°22		337°09
20	156°65	-0°06	-1°64	+6°05	+0°21		339°47
21	168°85	-0°03	-2°91	+6°57	+0°20		342°70
22	181°06	-0°01	-4°07	+6°82	+0°19		346°74
23	193°28	+0°02	-5°05	+6°76	+0°18		351°47
24	205°50	+0°05	-5°78	+6°39	+0°18		356°75
25	217°73	+0°07	-6°19	+5°71	+0°18		2°38
26	229°96	+0°10	-6°25	+4°71	+0°18		8°08
27	242°19	+0°12	-5°92	+3°42	+0°19		13°47
28	254°43	+0°14	-5°21	+1°90	+0°20		18°17
29	266°67	+0°16	-4°14	+0°22	+0°21		21°80
30	278°91	+0°19	-2°78	-1°51	+0°22		24°07
31	291°15	+0°21	-1°22	-3°15	+0°23		24°82
Sept. 1	303°39	+0°24	+0°43	-4°59	+0°25		23°98
2	315°62	+0°26	+2°04	-5°71	+0°27		21°64
3	327°84	+0°28	+3°51	-6°45	+0°28	+0°20	17°96
4	340°06	+0°31	+4°74	-6°77	+0°30	+0°21	13°21
5	352°27	+0°33	+5°68	-6°67	+0°32		7°69
6	4°48	+0°36	+6°29	-6°18	+0°33		1°76
7	16°67	+0°39	+6°57	-5°36	+0°34	+0°21	355°82

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Greenwich Midnight.	Selenographical Colong. Lat. of the Sun.	Geocentric Libration. Sel. Long. Lat. of the Earth.	Physical Libration. Long. Lat.	O.
1905. Sept. 8	28°87	+ 0°42	+ 6°54 - 4°28	+ 0°35 + 0°21 350°22
9	41°05	+ 0°45	+ 6°23 - 2°99	+ 0°35 345°27
10	53°23	+ 0°48	+ 5°67 - 1°58	+ 0°35 341°19
11	65°41	+ 0°51	+ 4°91 - 0°12	+ 0°35 338°13
12	77°58	+ 0°54	+ 3°97 + 1°33	+ 0°36 336°15
13	89°76	+ 0°57	+ 2°89 + 2°70	+ 0°35 335°26
14	101°93	+ 0°60	+ 1°70 + 3°94	+ 0°33 335°42
15	114°11	+ 0°62	+ 0°43 + 4°99	+ 0°32 336°59
16	126°29	+ 0°65	- 0°88 + 5°83	+ 0°31 338°71
17	138°46	+ 0°68	- 2°19 + 6°41	+ 0°30 341°70
18	150°64	+ 0°70	- 3°46 + 6°72	+ 0°29 345°48
19	162°84	+ 0°73	- 4°63 + 6°74	+ 0°28 + 0°21 349°96
20	175°03	+ 0°75	- 5°64 + 6°47	+ 0°27 + 0°22 355°00
21	187°23	+ 0°77	- 6°44 + 5°89	+ 0°26 0°43
22	199°43	+ 0°79	- 6°95 + 5°02	+ 0°26 6°00
23	211°64	+ 0°82	- 7°10 + 3°87	+ 0°26 11°41
24	223°85	+ 0°84	- 6°85 + 2°47	+ 0°27 16°33
25	236°07	+ 0°85	- 6°15 + 0°89	+ 0°27 20°39
26	248°30	+ 0°87	- 5°01 - 0°80	+ 0°28 23°24
27	260°52	+ 0°89	- 3°46 - 2°48	+ 0°30 24°67
28	272°75	+ 0°91	- 1°62 - 4°01	+ 0°31 24°50
29	284°97	+ 0°93	+ 0°39 - 5°27	+ 0°32 22°71
30	297°19	+ 0°95	+ 2°40 - 6°16	+ 0°34 19°42
Oct. 1	309°41	+ 0°97	+ 4°22 - 6°62	+ 0°35 14°86
2	321°63	+ 0°99	+ 5°74 - 6°62	+ 0°36 9°36
3	333°83	+ 1°01	+ 6°84 - 6°21	+ 0°37 3°35
4	346°03	+ 1°03	+ 7°49 - 5°45	+ 0°38 357°25
5	358°22	+ 1°05	+ 7°70 - 4°40	+ 0°39 351°46
6	10°41	+ 1°07	+ 7°51 - 3°16	+ 0°39 346°32
7	22°59	+ 1°10	+ 6°98 - 1°78	+ 0°39 342°04
8	34°76	+ 1°12	+ 6°19 - 0°35	+ 0°39 338°76
9	46°93	+ 1°14	+ 5°19 + 1°07	+ 0°38 336°54
10	59°09	+ 1°16	+ 4°05 + 2°43	+ 0°37 335°39
11	71°25	+ 1°18	+ 2°82 + 3°66	+ 0°36 335°30
12	83°41	+ 1°20	+ 1°53 + 4°73	+ 0°35 336°21
13	95°57	+ 1°22	+ 0°23 + 5°59	+ 0°33 338°09
14	107°73	+ 1°24	- 1°07 + 6°21	+ 0°31 340°87
15	119°89	+ 1°26	- 2°34 + 6°56	+ 0°30 + 0°22 344°45

H

Greenwich Midnight.	Selenographical		Geocentric Libration.		Physical Libration.		O.
	Colong. of the Sun.	Lat.	Sel. Long. of the Earth.	Lat.	Long.	Lat.	
1905. Oct. 16	132°05	+1°27	-3°56	+6°62	+°028	+°023	348°75
17	144°21	+1°29	-4°70	+6°40	+°027		353°63
18	156°38	+1°30	-5°70	+5°89	+°027		358°91
19	168°55	+1°32	-6°53	+5°10	+°026		4°37
20	180°73	+1°33	-7°12	+4°05	+°025		9°73
21	192°91	+1°34	-7°40	+2°77	+°025		14°70
22	205°10	+1°35	-7°30	+1°30	+°026		18°97
23	217°29	+1°36	-6°77	-0°28	+°026		22°23
24	229°49	+1°37	-5°76	-1°89	+°027		24°22
25	241°70	+1°38	-4°30	-3°43	+°028		24°76
26	253°90	+1°39	-2°45	-4°77	+°029		23°71
27	266°12	+1°40	-0°33	-5°79	+°030		21°08
28	278°33	+1°40	+1°86	-6°39	+°031		16°98
29	290°53	+1°41	+3°92	-6°53	+°033		11°70
30	302°74	+1°42	+5°68	-6°22	+°033		5°65
31	314°94	+1°43	+6°99	-5°52	+°034		359°32
Nov. 1	327°13	+1°44	+7°79	-4°50	+°034		353°19
2	339°32	+1°45	+8°08	-3°26	+°034		347°67
3	351°50	+1°47	+7°89	-1°89	+°034		343°05
4	3°67	+1°48	+7°32	-0°46	+°033		339°47
5	15°84	+1°49	+6°43	+0°95	+°032		336°98
6	28°00	+1°49	+5°33	+2°30	+°032		335°58
7	40°16	+1°50	+4°08	+3°53	+°030		335°29
8	52°31	+1°51	+2°77	+4°59	+°028		335°92
9	64°45	+1°51	+1°44	+5°45	+°027		337°56
10	76°60	+1°52	+0°14	+6°08	+°026		340°11
11	88°74	+1°52	-1°11	+6°45	+°024		343°51
12	100°88	+1°53	-2°29	+6°53	+°022	+°023	347°66
13	113°03	+1°53	-3°39	+6°33	+°021	+°024	352°43
14	125°17	+1°53	-4°40	+5°84	+°019		357°63
15	137°31	+1°53	-5°29	+5°07	+°018		3°09
16	149°46	+1°53	-6°03	+4°06	+°017		8°46
17	161°62	+1°53	-6°58	+2°83	+°017		13°49
18	173°78	+1°53	-6°89	+1°43	+°016		17°87
19	185°94	+1°52	-6°89	-0°08	+°017		21°35
20	198°11	+1°52	-6°52	-1°62	+°017		23°70
21	210°29	+1°51	-5°74	-3°11	+°018		24°72
22	222°47	+1°51	-4°53	-4°44	+°018	+°024	24°32

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	Greenwich Midnight.	Selenographical		Geocentric Libration.		Physical Libration.		O.
		Colong. of the Sun.	Lat.	Sel. Long. of the Earth.	Lat.	Long.	Lat.	
1905.								
Nov.	23	234°66	+ 1°50	- 2°93	- 5°51	+ °019	+ °024	22°51
	24	246°84	+ 1°50	- 1°02	- 6°22	+ °020		19°00
	25	259°05	+ 1°50	+ 1°03	- 6°50	+ °021		14°26
	26	271°24	+ 1°49	+ 3°04	- 6°32	+ °021		8°48
	27	283°44	+ 1°49	+ 4°82	- 5°71	+ °022		2°11
	28	295°63	+ 1°48	+ 6°22	- 4°73	+ °022		355°67
	29	307°82	+ 1°48	+ 7°13	- 3°49	+ °023		349°69
	30	320°01	+ 1°48	+ 7°54	- 2°09	+ °022		344°55
Dec.	1	332°18	+ 1°48	+ 7°45	- 0°62	+ °022		340°50
	2	344°36	+ 1°47	+ 6°95	+ 0°84	+ °021		337°60
	3	356°52	+ 1°47	+ 6°10	+ 2°23	+ °020		335°87
	4	8°69	+ 1°46	+ 5°01	+ 3°48	+ °018		335°25
	5	20°84	+ 1°45	+ 3°76	+ 4°57	+ °017		335°66
	6	32°98	+ 1°44	+ 2°43	+ 5°45	+ °015	+ °024	337°06
	7	45°13	+ 1°44	+ 1°11	+ 6°09	+ °013	+ °025	339°36
	8	57°27	+ 1°43	- 0°16	+ 6°47	+ °011		342°54
	9	69°40	+ 1°42	- 1°34	+ 6°58	+ °009		346°50
	10	81°54	+ 1°40	- 2°40	+ 6°39	+ °007		351°14
	11	93°67	+ 1°39	- 3°34	+ 5°91	+ °005		356°30
	12	105°80	+ 1°38	- 4°13	+ 5°15	+ °005		1°76
	13	117°93	+ 1°36	- 4°78	+ 4°13	+ °004		7°23
	14	130°06	+ 1°34	- 5°28	+ 2°90	+ °003		12°41
	15	142°20	+ 1°33	- 5°62	+ 1°49	+ °003		16°98
	16	154°34	+ 1°31	- 5°76	- 0°01	+ °002		20°66
	17	166°48	+ 1°29	- 5°76	- 1°54	+ °003		23°24
	18	178°64	+ 1°28	- 5°30	- 3°01	+ °003		24°58
	19	190°80	+ 1°26	- 4°64	- 4°34	+ °003		24°57
	20	202°96	+ 1°24	- 3°66	- 5°43	+ °004		23°17
	21	215°13	+ 1°22	- 2°38	- 6°20	+ °005		20°38
	22	227°31	+ 1°20	- 0°87	- 6°57	+ °006		16°27
	23	239°50	+ 1°19	+ 0°78	- 6°52	+ °006		11°02
	24	251°68	+ 1°17	+ 2°42	- 6°02	+ °008		4°96
	25	263°87	+ 1°16	+ 3°91	- 5°14	+ °008	+ °025	358°52
	26	276°06	+ 1°14	+ 5°13	- 3°93	+ °008	+ °026	352°25
	27	288°25	+ 1°12	+ 5°96	- 2°52	+ °008		346°62
	28	300°44	+ 1°11	+ 6°36	- 0°99	+ °007		342°00
	29	312°62	+ 1°09	+ 6°34	+ 0°54	+ °006		338°56
	30	324°80	+ 1°07	+ 5°91	+ 2°01	+ °005		336°36
	31	336°97	+ 1°05	+ 5°15	+ 3°35	+ °004	+ °026	335°36

The longitudes are reckoned in the plane of the Moon's equator, the axis of reference being the radius which passes through the mean centre of the visible disc. This axis therefore rotates with the Moon, and is not fixed in space.

The inclination of the Moon's equator to the ecliptic is taken as $1^{\circ}52'3''$, the value used in the *Nautical Almanac*.

The physical librations in longitude and latitude, as given by Professor Franz's formulæ, have been applied; their values are also printed separately, so that those who prefer to use Hayn's coefficients (*Ast. Nach.* 3956) can do so. His longitude coefficient is about one quarter of Franz's. Thus to reduce to Hayn's value we apply three-quarters of the printed physical libration in longitude with its own sign to Sun's colongitude, and with reversed sign to selenographical longitude of the Earth.

The colongitude of the Sun is 90° (or 450°) *minus* his selenographical longitude. It is numerically equal to the selenographical longitude of the morning terminator reckoned eastward from the mean centre of the disc. Hence its value is approximately 270° , 0° , 90° , 180° at new Moon, first quarter, full Moon, last quarter respectively. The longitude of the evening terminator is of course 180° greater or less than that of the morning one.

When the geocentric libration in longitude is positive, the region brought into view is on the west limb; when negative, on the east.

When the geocentric libration in latitude is positive, the region brought into view is at the Moon's north pole; when negative, at the south.

As it did not appear that anyone made use of the "Combined Amount" columns they have been omitted. They can, of course, be derived from the librations in Longitude and Latitude by a method analogous to the transformation from rectangular to polar coordinates.

C denotes the geocentric position-angle of the northern extremity of the Moon's axis measured eastward from the northernmost point of the disc. It has been computed by the second formula given in the Preface to the *Nautical Almanac*.

The terms "East" and "West" are used throughout with reference to our sky, and not as they would appear to an observer on the Moon.

I give the method for finding the altitude of the Sun at a given point on the Moon whose position is defined: (1) by selenographical longitude and latitude; (2) by direction cosines.

In either case the Sun's selenographical colongitude and latitude (K, L supposed) must be found by interpolation from the ephemeris for the given time.

In the first case let the given point be in the position longitude M, latitude N. Longitudes are reckoned from the meridian passing through the mean centre of the disc, and the

positive direction is that towards the Mare Crisium. North latitudes are considered positive.

Then

$$\text{sine Sun's altitude} = \sin L \sin N + \cos L \cos N \sin (K + M).$$

In the second case let ξ, η, ζ be the direction cosines of the given point. The axes are (1) that diameter of the Moon's equator which is 90° from the mean centre of the disc ; (2) the Moon's polar axis ; (3) the diameter through the mean centre of the disc. The positive directions are as above. Mr. Saunder has issued some maps of portions of the Moon's surface from which the co-ordinates ξ, η, ζ can be taken at sight.

Then the Sun's direction cosines are :

$$\cos K \cos L, \sin L, \sin K \cos L,$$

and sine Sun's altitude

$$= \xi \cos K \cos L + \eta \sin L + \zeta \sin K \cos L.$$

Neither formula is convenient when the Sun's altitude is very great, for an angle near 90° cannot be accurately determined from its sine. However, when the Sun is high the shadows are so inconspicuous that it is not necessary to compute his altitude with great accuracy.

Benvenue, 55 Ulundi Road, Blackheath, S.E. :
1904 October 17.